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# Plant Growth and Changes



**Learning  
Technologies  
Branch**





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# Science 4

## Plant Growth and Changes

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Module 4: Plant Growth and Changes  
Student Module Booklet  
Learning Technologies Branch  
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This document is intended for	
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Teachers	✓
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Other	



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- Alberta Education, <http://www.education.gov.ab.ca>
- Learning Technologies Branch, <http://www.education.gov.ab.ca/lrb>
- Learning Resources Centre, <http://www.lrc.education.gov.ab.ca>

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# Welcome

## to Module 4 of Science 4

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Wheels, Gears,  
and Levers

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and Changes

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Waste and  
Our World

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Module 6  
Relationships

There are six modules in this course. It is recommended that you work through the modules in order because the concepts and skills introduced in one module will be reinforced, extended, and applied in later modules.

Module 1 contains general information about the course components, additional resources, icons, assessment, and strategies for completing your work. If you do not have access to Module 1, contact your teacher to obtain this important information.



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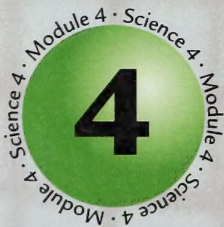
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# Module Overview

There are many living things on this planet. You and billions of other people share Earth with many plants and animals. In this module, you look at plants and their needs. You will begin by looking at the parts of a plant and what plants need to live. Then you will find out about growing plants, and the stages in their growth.

You would not survive on Earth if it weren't for green plants. Plants provide you with food and shelter. They also clean the air you breathe. In this module, you will explore the ways we use plants to keep us alive. You will look at the places where plants grow. You will look at some plants that have developed special ways of obtaining what they need from harsh environments. You will also find out about plants that grow in temperate regions, in deserts, and in rainforests.

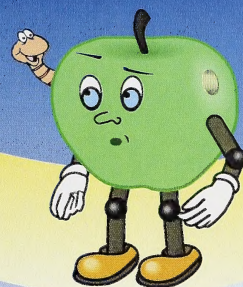


## Module 4 Plant Growth and Changes

### Section 1 Understanding Plants

### Section 2 Adaptable Plants





## How Will You Be Marked?

Your mark on this module will depend on how well you complete the two Assignment Booklets.

This is how the marks are distributed:

### Assignment Booklet 4A

Section 1 Assignment	<u>74 marks</u>
Total	74 marks

### Assignment Booklet 4B

Section 2 Assignment	<u>53 marks</u>
Total	53 marks

Be sure to check with your teacher to see if this mark distribution is appropriate for you. Some teachers like to include other reviews and assignments. When you get the assignments back from your teacher, be sure to read the comments and talk about them with your home instructor.

When you do the assignments, work slowly and carefully under the instruction of your home instructor or teacher. You may use your course materials to help you, but you must do the assignments by yourself.



# Section 1

## Understanding Plants

### Introduction



Many factors affect the growth of a plant. You cannot control all of them. In this section, you study the parts of a plant and how the parts work together to keep the plant alive. You will grow some plants of your own. You will study what conditions are needed to grow strong, healthy plants. You will also study the life cycle of plants. By the end of this section, you will have quite a number of plants to enjoy!





# Lesson 1: What Plants Need

Would you feed pizza to a plant? Probably not!



**nutrients:**  
substances that  
nourish or feed

Plants have special needs. Farmers and gardeners understand plants. They know how to help them grow. Not all people like pizza; nor do all plants need the same **nutrients**. Today, you will discover what plants need to live.

The basic needs of plants are sunlight, water, and soil.

## Sunlight

When the Sun rises in the morning, green plants begin to make food. Green plants need sunlight to grow.





**chlorophyll:** the green pigment (colouring) of plants; needed for photosynthesis to absorb the light energy of the Sun

**glucose:** a simple sugar

**carbon dioxide:** a colourless gas that plants absorb from the air

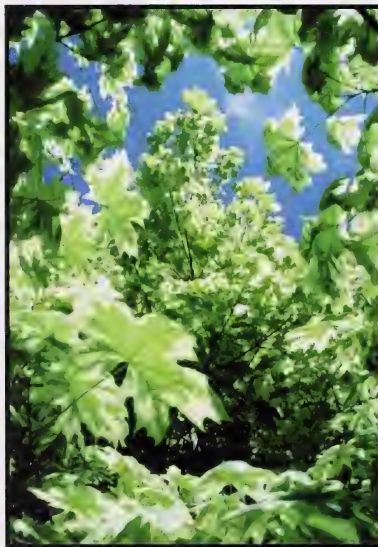
**photosynthesis:** the process by which plants use sunlight, carbon dioxide, and water to make a type of sugar

The green colour in a plant's leaves is a compound called **chlorophyll**. Chlorophyll absorbs light energy from sunlight. Plants use this light energy to make **glucose** (a simple sugar) from **carbon dioxide** and water. The name for this process is **photosynthesis**. You will look closer at photosynthesis in Lesson 2.

The sugar produced in photosynthesis is food for the plant. You can taste the sweetness in some plants. The sugar that you buy in a store likely came from sugar beets or from the stem of the sugar cane plant. In Canada, the sugar maple tree is one of the sweet plants. When boiled, sap from sugar maple trees makes delicious maple syrup. It also makes a special treat when poured on snow!



## Water



Imagine eating with your toes! Plants do something similar. Plant roots get water and minerals from the soil. Gardeners water around the base of a plant's stem so the roots can absorb the water. Moisture travels up through the stems of plants until it reaches the leaves. Lack of water can make a plant droop. The top will hang over and the leaves will wilt. This plant is thirsty. It needs water. Some plants can also absorb water through their leaves.



Imagine

Some plants can even drink fog! Canada's west coast has cool-climate (temperate) rain forests. These forests get plenty of rain, but in summer when it is drier, these forests get a lot of fog. The trees drink in this moisture through their leaves.



## Soil

Plants usually need good soil to grow. If the soil is hard and dry, the roots cannot move through the soil. The plant cannot grow if its roots can't grow. Gardeners use spades and pitchforks to break up soil. They may also add nutrients to the soil by adding **fertilizer** or **compost**. **Mulches** of straw, bark, or manure can be used to cover and protect the soil and the plant roots.

**fertilizer:** a substance put in soil to improve plant growth

**compost:** decayed organic matter

**mulch:** straw, bark, or manure spread to protect soil and plant roots





Not all plants grow in the same conditions:

- Some plants can grow in hot climates.
- Others can grow in very cold climates.
- Some plants like plenty of water.
- Other plants can survive in the hot, dry desert.
- Some plants can grow in hard, dry soil. In fact, some even grow in cracks in the pavement!



Some plants grow well in sunny, hot, dry places with little water. Think of a cactus in a desert. These plants store water in their stems for a long time. Their thick outer skins help keep water in the stem, so the plants can survive long periods without rain. Did you know that the spines of a cactus are its leaves?

Some plants grow without much light. The forest floor is a shady place. Ferns and small flowers grow there. Their leaves are often large, and shaped to catch as much sunlight as possible.





Some plants like water so much that they grow in ponds! Water lilies send their roots down to the bottom of a pond. The big leaves of the water lily float on the water surface to collect sunlight.



### Imagine

The seed of a plant is like a little bag of food. When you water a seed, it swells. Soon it bursts. When this happens, the seed leaves point upward. The seed root points downward. At first, the seedling uses the nutrients stored in the seed as food. As the plant gets bigger, its leaves open up, and it can start to make its own food through photosynthesis. At the same time, its root grows down into the soil. The root anchors the plant and gathers nutrients from the soil.



The Missouri Botanical Garden has an interesting website. You can explore some different plant communities, such as rain forests, deserts, and grasslands at this site.

<http://mbgnet.mobot.org>



# Activity 1: *Growing a Bean Plant*

Would you like to do the following?

- grow your own plants
- see what happens when you water seeds
- watch your plants grow when you put the seeds in soil

This activity will take a few days to finish.  
Visit your set-up each day.

## What you need

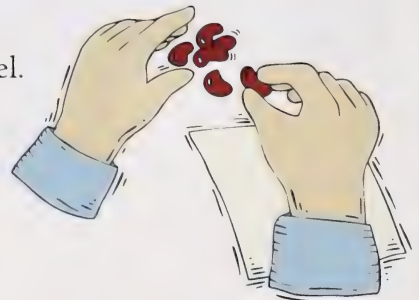


- soil
- 4 saucers or pie plates
- 4 pieces of paper towel
- 4 dried beans (from a seed packet)
- 4 pieces of paper, slightly smaller than the saucers
- a plastic container or a small potting container
- a nail (if a potting container isn't used)



## What to do

1. Soak the beans in a cup of water overnight.
2. Soak each piece of paper towel in water. Fold each towel to fit on a saucer.
3. Place one bean on each paper towel.





4. Put a piece of paper on top of each bean. Place the saucers in four different places:

- in bright light (in front of a window)
- in the light but not near a window
- in a dark, warm place (for example, a closet)
- in a dark, cold place (in the fridge)

Check the plates each day. Keep the paper towels moist, but not too wet.

5. Check your seeds each day until you notice that some of the seeds are lifting up the pieces of paper. Draw the bean seeds in each location. Use the boxes below. Label the young root and leaves.

<b>Seed 1</b> brightly lit, warm	<b>Seed 2</b> low light, warm	<b>Seed 3</b> dark, warm	<b>Seed 4</b> dark, cold

6. How do you think the beans lifted the paper?

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7. Which seed grew the best?

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8. Why did this seed grow the best?

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9. Steps 10 and 11 of the activity must be done after your seeds have sprouted.



If you aren't using a potting container, ask an adult to use the nail to poke one or two holes in the bottom of the plastic container.

10. Fill the container with soil.

11. Plant one sprouted seed in the container. Keep it well-watered and in the light. Place a saucer or pie plate under the pot to catch any water that might flow through the pot. Check the growth of this bean plant while you complete this module. You may be able to use this plant in Lesson 4.



Check your answers for this activity in the Suggested Answers at the end of this lesson.

What do plants need to live?  
You've experimented with seeds and light. You've also watched as a seed developed into a plant. You used water and good soil to help the bean grow. These are the major things that plants need to grow and be healthy.







Turn to Assignment Booklet 4A and complete question 1 of the Section 1 Assignment.



## Activity 1: Growing a Bean Plant

5. Check your seeds each day until you notice that some of the seeds are lifting up the pieces of paper. Draw the bean seeds in each location. Use the boxes below. Label the young root and leaves.

Your beans may look something like this:

			
<p><b>Seed 1</b> brightly lit, warm</p>	<p><b>Seed 2</b> low light, warm</p>	<p><b>Seed 3</b> dark, warm</p>	<p><b>Seed 4</b> dark, cold</p>

6. How do you think the beans lifted the paper?

Water swelled the beans, and they began to sprout.

7. Which seed grew the best?

The seed in the light (bright or low light) grew best.

8. Why did this seed grow the best?

Bean seeds sprout better in warmth and light.



## Key Words

**carbon dioxide:** a colourless gas that plants absorb from the air

**chlorophyll:** the green pigment (colouring) of plants; needed for photosynthesis to absorb the light energy of the Sun

**compost:** decayed organic matter

**fertilizer:** a substance put in soil to improve plant growth

**glucose:** a simple sugar

**mulch:** straw, bark, or manure spread to protect soil and plant roots

**nutrients:** substances that nourish or feed

**photosynthesis:** the process by which plants use sunlight, carbon dioxide, and water to make a type of sugar

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# Lesson 2: *Roots, Stems, and Leaves*



It is time to discover how plants work. Plants are not like people. Humans have legs. They can walk to the grocery store and use their hands to collect food. They also use their hands to put food in their mouths. This food is digested in their stomachs. Plants cannot do any of these things. They do not have hands, legs, or stomachs. But they do have roots, stems, leaves, and flowers. Today, you will study roots, stems, and leaves.



## Roots

When you eat a carrot, you are eating the root of a carrot plant. You rarely see plant roots. They are usually underground, and they can spread through the soil. Roots anchor plants in the soil. Without roots, plants could blow away in the wind. What would happen if trees did not have roots?

Roots also absorb water and nutrients from the soil. Plants need this food to live. Some plants, such as carrots, store food in their roots. They store the food made in their leaves during photosynthesis.

## Stems

The heart pumps blood through arteries and veins in human bodies. Blood carries water, oxygen, and nutrients to all parts of the body. Plants need to transport food and water as well.



## Tree Growth Rings

**growth ring:** ring formed in a tree trunk during each year's growth; also called a **tree ring** or **annual ring**

A tree trunk is the stem of a tree. Tree trunks hold many secrets. If you look at the cut end of a tree trunk, you will see a pattern of rings. These are called **growth rings**. When the wood is wet, you can see the pattern more clearly. You will see light-coloured rings and dark-coloured rings. A light ring and dark ring together make up one year of growth. In the spring and early summer, a tree grows fast. This makes the light ring. In the late summer and fall, the tree grows slowly. This makes the darker ring.

The oldest part of the tree is in the middle. Starting in the middle, you can count the growth rings. This will tell you how many years the tree was alive.





The stem of a plant acts like a highway for travelling food. Layers of cells form two pipelines inside the stem. One of these pipelines takes sugar from the leaves. The sugar travels along the pipe, like juice through a straw. It goes to all parts of the plant. The other pipeline carries water and nutrients from the roots up to the leaves.

## Activity 2: *Mystery Travel*

Would you like to see how water travels up the stem of a plant? In this activity, you will see this in full colour!

### What you need



- a table knife
- a small spoon
- a celery stalk (with its leaves, if possible)
- a clear glass filled to a depth of at least 2 to 3 cm of water
- some food colouring (red or blue) or brightly-coloured drink crystals (Do not use yellow or green colours.)



### What to do



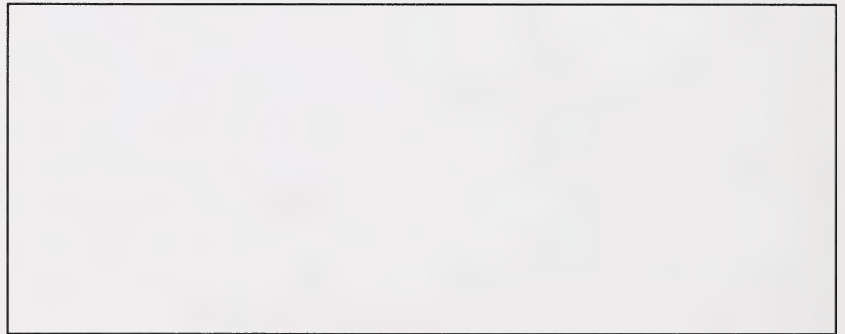
**Caution:** Take care using the knife. Use a cutting board and cut away from your body. Ask an adult to help you cut the celery in Step 2.

1. Stir the food colouring or drink crystals into the water.

2. Cut off the bottom end of the stalk of celery. Take a close look at the cut end of the stalk. Stand the celery in the glass, with the cut end in the coloured water.
3. Leave the celery in the coloured water for an hour or two.



4. Remove the celery from the glass. Look carefully at the cut end and draw what you see.



5. Put the celery stalk back in the water and leave it overnight.
6. What change do you see in the celery?

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7. Why did this happen?

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Check your answers for this activity in the Suggested Answers at the end of this lesson.

## Leaves

In winter, many trees and plants have no leaves. All you see are branches and trunks. In spring, suddenly there are buds, leaves, and flowers.

Leaf buds open when the weather warms up in the spring. Leaves must grow quickly because they have an important job to do. In order to grow, green plants need energy from the Sun. Leaves soak up sunlight to make food for the plant.



**veins:** thread-like pipes in a leaf

When you look at a leaf, you can see small **veins** running through it. These veins are like the pipes in the stem of a plant. Some carry nutrients and water to the leaves. Leaves also take in carbon dioxide from the air. Atoms from water and carbon dioxide are raw materials. A chemical reaction using energy from the Sun combines them. The plant makes a special type of sugar. This sugar is the plant's food!

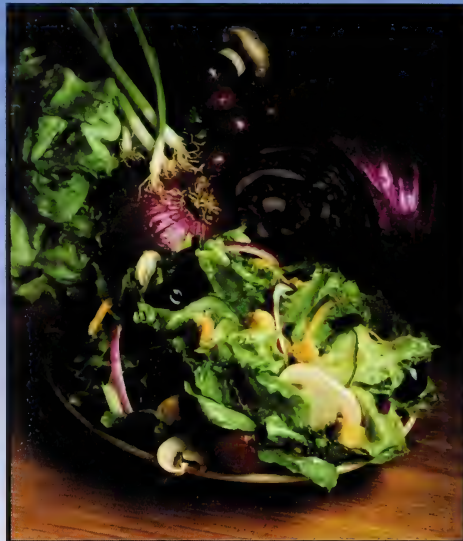
When the plant is covered in leaves, it begins to grow. Each leaf is busy making food for the plant. This helps the plant grow faster. When the plant has enough food, it can reproduce and create more plants. How do plants reproduce? It starts with a flower! You will find out more about flowers in Lesson 3.



Have fun making a salad (online) while you discover more about plant parts.

Visit this website developed by the Howard Hughes Medical Institute.

<http://www.hhmi.org/coolscience/vegquiz/index.html>



Turn to Assignment Booklet 4A and complete question 2 of the Section 1 Assignment.

## Suggested Answers

### Activity 2: Mystery Travel

4. Remove the celery from the glass. Look carefully at the cut end and draw what you see.

Your diagram will show that the coloured water has travelled up some of the tubes in the celery. The cut end of the celery will show circles filled with colour where the water has flowed.





6. What change do you see in the celery?

Parts of the celery stem and leaves changed colour.



7. Why did this happen?

Coloured water travelled up the pipelines in the celery stem to the leaves. The leaves needed water to make food for the plant. You can see (from the photograph in question 6) that the water level in the glass went down. Some water may have evaporated. The rest of the water travelled up the celery stem to the leaves.

## Key Words

**growth ring:** ring formed in a tree trunk during each year's growth; also called a **tree ring** or **annual ring**

**veins:** thread-like pipes in a leaf

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# Lesson 3: Flowers

A garden of flowers is a beautiful sight. Flowers have lovely colours, and they often have a wonderful scent as well. The colours and scent of flowers may be lovely to people, but they also have an important job. Today, you will explore flowers.

Flowers are made up of many parts. Think of an apple blossom.

The petals are the part of this flower that you see first. The petals lead insects into the centre of the flower. Flowers use bright colours, special designs, and scent to attract insects.

**stamen:** the male reproductive organ of a flower

**pistil:** the part of the flower that produces seeds

**pollen:** fine, yellowish particles that contain male reproductive cells of a plant

Several **stamens** and a **pistil** poke out from the centre of the flower. (These parts may be hard to see in some flowers. Petals may cover the whole flower, as in marigolds, peonies, and some roses. You may have to look very closely to find the centre of the flower.) The stamens are smaller than the pistil. The tops of the stamens produce **pollen** grains. Pollen looks like yellow or orange dust. The pollen grains contain the male reproductive cells of the plant.



Bees and other insects buzz from one flower to another. As they move, their wings and feet get covered in pollen. This is how pollen passes from flower to flower.



**pollination:** the process that occurs when pollen from stamens lands on pistils

**ovary:** the part of the pistil that contains the female reproductive cells of the plant

**fertilization:** the process that occurs when male reproductive cells unite with a female reproductive cell

When pollen from the stamens of the same type of plant falls on top of the pistil, **pollination** occurs. The male cells in the pollen travel down the pistil to the **ovary** at the base of the pistil. The ovary contains the female cells of the plants. It is where the life of a seed begins. During **fertilization**, the female cells of the ovary mix with the male cells in the pollen. The cells combine to form a seed, and it can start to grow.



Did you know that some flowers have only female parts or only male parts? A cucumber flower is one example. Talk to your home instructor about “imperfect” flowers.



Insects are not the only animals that pollinate flowers. Birds, such as hummingbirds, and even certain bats pollinate flowers.



Insects and other animals do not pollinate all plants. Many plants use the wind for pollination. If you have allergies, your eyes may water and you may sneeze a lot. This is probably because there is a lot of pollen in the air. Wind blows the pollen from plant to plant.

When a flower has been pollinated, its job is done so it usually dies. The petals dry up and fall off the plant.

Many plants produce fruit. The fruit is really the seed pod. The pod protects the seeds. Apples and peaches are actually seed pods. So are pea pods. They protect the seeds inside.



We eat the fruit (or seed pod) of many plants (grapes, cherries). We also eat many seeds (sunflower seeds, lima beans). Sometimes, we eat the seed pods and the seeds (green and yellow beans, cucumbers, tomatoes). Can you list other examples?



## Flower Clocks

Can flowers move?  
Even though they seem to stay still and move only when the wind blows, flowers can move. Some flowers like to face the Sun. As the Sun moves from east to west, the flower heads turn to follow it. Sunflowers are a good example of this. They are named for the Sun they look like. Their big, colourful heads try to catch as much Sun as possible.



If you practise, you can learn to tell the time by looking at a sunflower. It is like reading the hands of a clock. You don't have to watch for the clock hands to reach the 12. You will know it is lunch time when the flower faces straight south.



# Activity 3: *Smelling the Flowers*



Do you think you can pollinate a flower? Try this activity to move pollen from the stamen of one flower to the pistil of another.

## What you need



- 2 flowers (the same kind and preferably large blooms)
- a cotton ball or a Q-Tip™ (Roll up a small bit of the cotton ball and hold it in tweezers for more control.)
- a magnifying glass
- a paint shirt, apron, or other protective clothing
- microscope (optional)



Pollen stains clothing. Wear a paint shirt or apron to protect your clothes.



Check with your home instructor when you are identifying the plant parts. If you are using small flowers, use your magnifying glass.

## What to do

1. Use the space below to sketch your flower. Label the petals, stamen, pistil, pollen, and ovary.



2. How do you think your flower attracts insects?

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3. Now, it is time to do the work of a bee! The cotton ball or Q-Tip represents a bee. This bee is attracted to one of your flowers. It buzzes around the petals, looking for nectar. It has to go inside the flower for this. Gently push the cotton ball inside the flower. Which parts of the flower does the cotton ball touch?

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4. Look closely at the cotton ball or Q-Tip to see if it has collected any pollen.

Use the magnifying glass or microscope to look at some of the pollen. Sketch what you see in the space below.

A large, empty rectangular box with a black border, intended for a student to sketch what they see through a magnifying glass or microscope.

5. Now touch the pollen that is on the cotton ball to the top of the pistil in the second flower. This is how flowers are pollinated.

6. How do insects pollinate flowers?

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7. What are some other ways that pollination can occur?

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Check your answers for this activity in the Suggested Answers at the end of this lesson.



You can find out more about pollination and pollinators by visiting the website sponsored by the National Gardening Association.



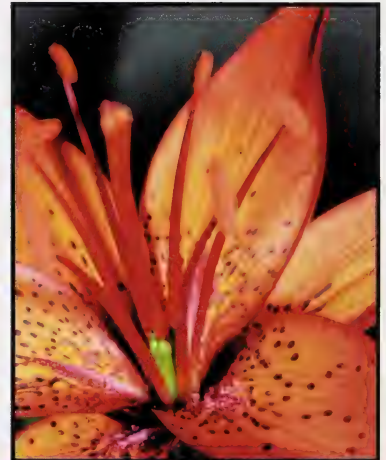
Search for articles about pollination.

<http://www.kidsgardening.com>

Flowers are much more than pretty colours and beautiful smells. They contain the reproductive parts of plants.

Flowers, like this lily, use bright colours, special designs, and scent to attract insects. Insects help pollinate flowers.

Without flowers, there would be no new plants.



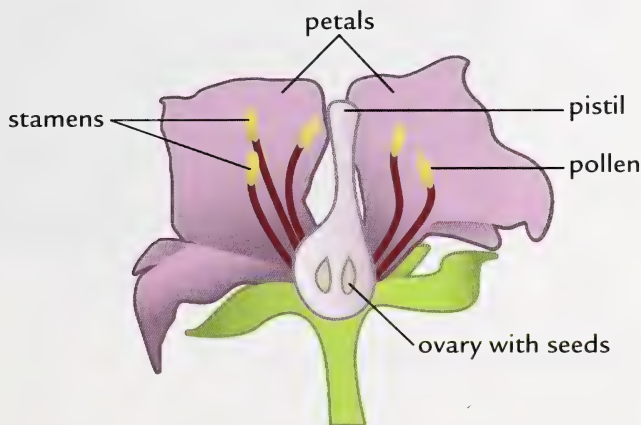
Turn to Assignment Booklet 4A and complete question 3 of the Section 1 Assignment.



## Activity 3: Smelling the Flowers

1. Use the space below to sketch your flower. Label the petals, stamen, pistil, pollen, and ovary.

Drawings will vary. Look at the following diagram to see that you have correctly labelled the parts of the flower.



2. How do you think your flower attracts insects?

Answers will vary depending on the flower you chose. You may have described the petal size, colour, and shape; the flower's scent; and patterns on petals.

3. Now, it is time to do the work of a bee! The cotton ball or Q-Tip represents a bee. This bee is attracted to one of your flowers. It buzzes around the petals, looking for nectar. It has to go inside the flower for this. Gently push the cotton ball inside the flower. Which parts of the flower does the cotton ball touch?

Your cotton ball or Q-Tip will pick up pollen from the stamens.

4. Look closely at the cotton ball or Q-Tip to see if it has collected any pollen.

Use the magnifying glass or microscope to look at some of the pollen. Sketch what you see in the space below.

Pollen grains will vary depending on the plant used.



Pollen from a variety of common plants: sunflower, morning glory, hollyhock, lily, primrose, and castor bean

6. How do insects pollinate flowers?

Insects transfer pollen from one flower to another by carrying it on their feet, legs, bodies, and wings.



7. What are some other ways that pollination can occur?

Wind and animals, such as some bats and birds, can also pollinate flowers.



## Key Words

**fertilization:** the process that occurs when male reproductive cells unite with a female reproductive cell

**ovary:** the part of the pistil that contains the female reproductive cells of the plant

**pistil:** the part of the flower that produces seeds

**pollen:** fine, yellowish particles that contain male reproductive cells of a plant

**pollination:** the process that occurs when pollen from stamens lands on pistils

**stamen:** the male reproductive organ of a flower

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# Lesson 4: Your Green Thumb



Have you ever heard of the term “green thumb”? People are said to have a green thumb if they are able to grow healthy plants. In today’s lesson, you will plant seeds. Hopefully, one seed will develop into a healthy plant over the next few weeks.



When you go to a greenhouse, you see plants that are ready to move into your own garden or plant pots. They are already part-way through their **growth cycle**.

**growth cycle:** the different steps a plant goes through from seed to maturity and production of new seeds

**maturity:** at the adult stage of life

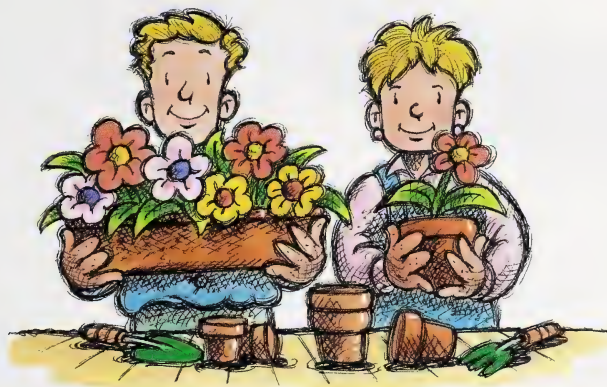
**growing season:** the number of days that the conditions are right for growing plants outdoors

Every spring in Alberta, we flock to our local greenhouses. We buy flowers and vegetables that are already on their way to **maturity**. We do this because we have such a short **growing season**. What would happen if we were to plant seeds when the ground thaws in the spring? Many plants would not have enough time to grow before the frosts in early fall.





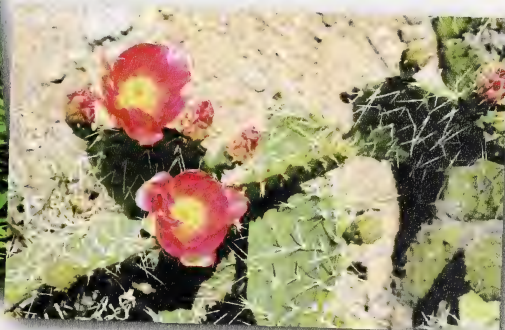
Some people choose to start their plants at home. They plant seeds in containers and replant the seedlings outside when the risk of frost is gone. This takes a lot longer and requires a lot of patience.



To grow plants from seed, you need to understand the needs of each type of plant. When you are preparing to grow your own garden, you must research each type of plant. You find out the best growing conditions for each one you want to grow. Some plants thrive in damp, shady locations. Others grow best in a hot, dry desert. Each plant is different.



- Some plants need direct sunlight.
- Some need partial sunlight.
- Some need shade.
- Some need the soil to be completely dry before watering.
- Some need the soil to be damp all the time.



When you buy a plant, or seeds, how do you know what conditions are needed?



You can read the seed packet, or the plant tag, or you can ask the people working in the greenhouse.

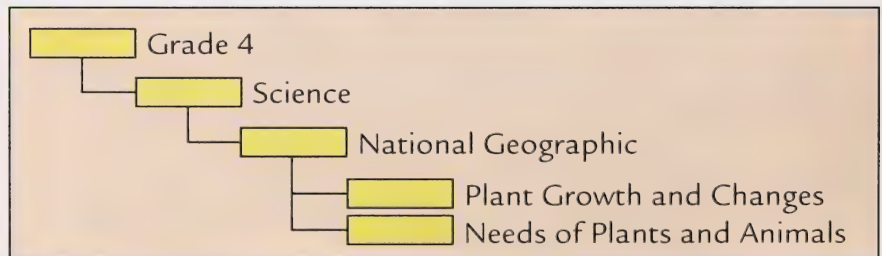
There are a large variety of film clips on the LearnAlberta website. The clips show how to care for plants, the lifecycle of plants, time-lapse films of plants growing from seeds, and much more.

You will need a password and user ID, which your school can provide.



<http://www.learnalberta.ca>

Once you log in, follow this path:





# Activity 4: Growing Your Own Plant



To be successful in this activity, it is best to plant a lot of seeds. You can choose a few plants to use once they begin to grow. You will grow a few plants and care for them. You are to raise at least one mature plant with seeds. This will complete the life cycle of the plant.

This is a long-term activity. You will have to visit and care for your plant(s) even after you finish this module.

## What you need



- potting soil
- a package of seeds (dwarf marigold or another quick-growing annual seed suggested by a local greenhouse)
- a small plant pot (The size depends on the plant you are going to grow. You will likely have to transplant and fertilize your plant before it reaches maturity.)



## What to do

1. What type of plant did you decide to grow?

\_\_\_\_\_

2. What type of growing conditions should be used for this plant? (**Hint:** Read the seed packet or ask the people at your local greenhouse.)

- Soil type or growing medium \_\_\_\_\_
- Amount of light \_\_\_\_\_
- Watering schedule \_\_\_\_\_
- Best temperature for growth \_\_\_\_\_

3. Plant your seeds to the depth indicated on the package. Try to match the conditions you listed in Step 2.

4. Over the next few weeks, record the growth of your plant on the following chart. Enter the date that you plant the seeds and the date the first sprout appears. Enter dates that other changes are noted. Include things such as growth spurts and changes in appearance.

Under “Observation,” include anything you do to care for the plant and any interesting things that happen.

Under “Illustration,” draw and colour pictures to show what you are describing.



Discuss any problems and changes with your home instructor. Check your plants every day to make sure they are getting enough sunlight, water, and nutrients.





Date	Observation	Illustration
Planted on		
First sprout appears		
Change in appearance		
Change in appearance		
Change in appearance		
Change in appearance		
Change in appearance		



5. When your plant reaches maturity, it will have produced seeds. Look at pictures of your plant in books or on the Internet. Find a picture showing the seeds. Explain where the seeds are found on the plant, and what is protecting them. (Once your plant reaches maturity, you will be able to confirm this information first-hand!) Does the seed your plant produced look like the seed you planted?

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6. Keep notes about the growth of your plant, and how it is affected by your care. You can use your notes to write a report for an Optional Follow-up Activity at the end of Section 2.



Check your answers for this activity in the Suggested Answers at the end of this lesson.

This activity will continue for quite a few weeks. At the end of your plant's life cycle, which could be a few months from now, you will have cared for a plant to nurture it from seed to maturity.

Perhaps in the spring, you will want to grow your own garden!



Turn to Assignment Booklet 4A and complete question 4 of the Section 1 Assignment.



## Suggested Answers

1.–6. This activity has no simple answer. Each seed planted can give different results. What is important is that you actually do the following:

- Plant the seeds.
- Water and nurture the seedlings.
- Continue to care for the plant.
- Watch for the plant to flower.
- Collect the seeds.

You have to be organized, patient, and reliable to successfully raise a plant.

## Key Words

**growing season:** the number of days that the conditions are right for growing plants outdoors

**maturity:** at the adult stage of life

**growth cycle:** the different steps a plant goes through from seed to maturity and production of new seeds

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# Lesson 5: Life Cycles

People often use sayings such as the ones under the photos to describe the way things change.



"From little acorns do great oak trees grow."



"He's growing like a weed."

Plants grow quickly. Some plants live for only one year. In this time, they must sprout, grow, flower, and reproduce. Plants have busy lives! Today, you will follow the life cycle of a plant.

When you look at a seed, it is hard to imagine that a plant—even a huge tree—can grow from this small object.

**embryo:** the undeveloped plant within a seed

Seeds contain tiny **embryos**, or undeveloped plants. These embryos grow into the roots, shoots, and leaves of a seedling. The seed also contains enough food to help the undeveloped plant, or embryo, sprout.





Most plants produce many more seeds than will actually grow. Think of how many seeds there are in an apple. Now, imagine how many seeds there would be on a tree covered with apples. If all the seeds sprout, there would be too many apple trees. The tree produces many seeds because only a few will survive. Seeds need exactly the right conditions to sprout, or **germinate**.

**germinate:** to begin  
to grow or sprout

Seeds from plants that grow in cold climates often will not germinate until they have been cold for at least two months. The seeds wait for winter to end and for the ground to warm up. When spring comes, the snow melts and makes the ground wet. Rain falls. All this moisture makes seeds swell. It softens the hard outer seed coat.



Soon a tiny root pokes out and grows down into the soil. Before long, the seedling is shooting up, and leaves are unfolding.



There are many types of flowering plants. Each type blooms at a certain time of year. Some flowers, like the crocus, bloom very early in the spring. Other early spring flowers are tulips and daffodils. Other plants flower in summer. Vegetables (such as peas and cucumbers), berries (such as raspberries and blueberries), and crops (such as clover and canola) bloom in summer. Bees and other insects are very busy during the summer. They have many flowers to pollinate!

When the flowers have been pollinated, the petals fall away. The seed pods, or fruit, now begin to grow. Apple blossoms become apples, bean flowers become bean pods, and roses become rosehips. Many seed pods are eaten by birds and animals. Many are harvested by gardeners and farmers for our food.



**annual:** a plant that grows for only 1 year or season

**perennial:** a plant that lives for more than 2 years or growing seasons

Some flowering plants live only 1 year. These plants are called **annuals**. Other types of flowering plants live for more than 2 years. These plants are called **perennials**. Perennials flower year after year. Perennials have to survive winter. Some die back and leave only their roots. New shoots start to grow in the spring.





**deciduous:**

referring to trees that lose their leaves in winter

**coniferous:**

referring to trees that have needle-shaped evergreen leaves and bear seeds in cones; needles remain over winter

**Deciduous** trees are trees that lose their leaves in winter.

**Coniferous** trees, such as spruce and pine, have needles as their leaves. These trees do not lose their needles every autumn.



The leaves of deciduous trees turn colour in autumn.



The leaves of a coniferous tree are green needles that stay on the tree all year.

When winter comes, the life cycle of plants is complete. The plants wait for spring, when the cycle begins again.



To discover more about seeds, visit the Kids Gardening website.

Do a search using the word "seeds."

<http://www.kidsgardening.com>



# Activity 5:

## Perfect Conditions

Why do some seeds germinate, while others do not? In this activity, you will find out what conditions seeds need to germinate.

### What you need



- a tablespoon
- 4 small, self-closing sandwich bags
- 4 spoonfuls of one type of seed\*
- water and a small bowl
- masking tape
- a felt pen

\* alfalfa, radish, or raw sunflower seeds or mung beans

### What to do

1. Soak the seeds or beans in water overnight. Add a spoonful of soaked seeds or beans to each bag. Close the bag.
2. Use the masking tape and the felt pen to label the bags 1, 2, 3, and 4.
  - Place Bag 1 in the fridge.
  - Place Bag 2 in front of a warm, sunny window.
  - Place Bag 3 in a dark closet.
  - Place Bag 4 in a bright spot that is not in direct sunlight.
3. Check the bags each day for a week. Use the following table to record any growth or other changes. Draw what you see each day.





Day	Bag 1	Bag 2	Bag 3	Bag 4
	Fridge	Sunny Window	Dark Closet	Bright Spot
1				
2				
3				
4				
5				
6				
7				

4. In which bags did the seeds sprout best?

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5. Which conditions seem to be best for germination?

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6. Do all the seedlings look exactly the same? Explain any differences.

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Check your answers for this activity in the Suggested Answers at the end of this lesson.



This activity looks at the best conditions for seeds to germinate. This is only the beginning of a plant's life cycle. Some of the seedlings will grow into mature plants, flower, and produce seeds for more new plants. Others will not grow because the conditions were not right.



















Turn to Assignment Booklet 4A and complete question 5 of the Section 1 Assignment.



## Activity 5: Perfect Conditions

- Check the bags each day for a week. Use the following table to record any growth or other changes. Draw what you see each day.

Your drawings may vary slightly. The sample answer shows radish seeds germinating.

Day	Bag 1	Bag 2	Bag 3	Bag 4
	Fridge	Sunny Window	Dark Closet	Bright Spot
1				
2				
3				
4				
5-7	The drawings for days 5 to 7 will vary greatly, depending on the condition of the seeds and the conditions the seeds were placed in.			

4. In which bags did the seeds sprout best?

The seeds that were not in direct sunlight probably grew best. The bag that was out of direct sunlight may have grown better than the seeds in a sunny window, as the window setting may have become too hot. As well, the seeds may have become mouldy. The seeds in the closet also may have sprouted. The seeds in the fridge probably did not sprout or they may have sprouted later than those in other places, as conditions were too cold.

5. Which conditions seem to be best for germination?

Warmth and light without too much direct sunlight seem to be the best conditions for germination.

6. Do all seedlings look exactly the same? Explain any differences.

No, growth will be varied. Seedlings in the dark wouldn't be very green. Seeds and seedlings in too much heat or in the dark may also have begun to grow mould.

### Key Words

**annual:** a plant that grows for only 1 year or season

**embryo:** the undeveloped plant within a seed

**coniferous:** referring to trees that have needle-shaped evergreen leaves and bear seeds in cones; needles remain over winter

**germinate:** to begin to grow or sprout

**deciduous:** referring to trees that lose their leaves in winter

**perennial:** a plant that lives for more than 2 years or growing seasons



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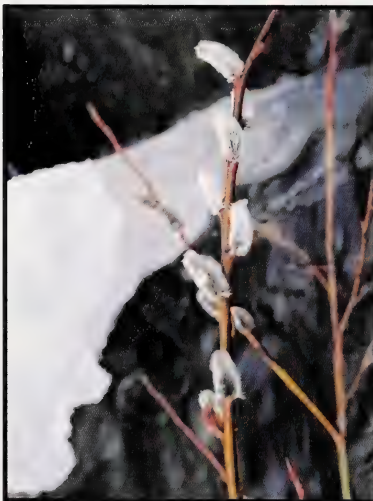
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# Lesson 6: Starting Plants

You know that plants grow from seeds. Not all plants start out as seeds. Today, you will look at different ways of growing plants.



**cutting:** a part cut from a plant to grow a new plant



If you plant a willow branch in the ground, it will grow. New roots will form at the bottom of the branch. This is one way to grow new plants. First, you carefully cut a part of a plant stem. This is “taking a **cutting**.” Plant the cutting up to its leaves in a special, moist soil mixture. Leave it to grow roots. Cuttings can also be put in water until they grow roots.

**clone:** a plant that is identical to its parent; a plant produced by cuttings, runners, or bulbs

A cutting and its “parent” are exactly the same. This is different from a new plant that grows from a seed. A cutting is a **clone** of its parent. Some plants make clones very easily. A single leaf from a jade plant will grow roots if it falls onto soil. You can get new bamboo plants by planting any piece of stem that has or had leaves on it.



Many clones grow naturally without a gardener’s help. Sometimes an old tree stump will send up a young tree. Black spruce trees are known for growing clones. Their branches droop down. Sometimes they get covered with soil. When this happens, the branches grow roots, and a new tree sprouts up.

**runner:** a stem that grows along the ground and takes root



Some plants and trees grow **runners** or suckers. These are like roots. They spread out along the ground or dangle from the plant. A new plant grows at the end of the runner. In time, the runner dies away, and the new plant is separated from the parent plant.

Strawberry plants, lilac bushes, and spider plants grow this way. Strawberry plants also produce seeds, so they have two ways of reproducing.

Another way to grow plants is from bulbs. Some plants store all their food in an underground bulb.



Daffodils, tulips, crocuses, onions, and garlic all grow from bulbs. These plants do produce flowers and seeds, but they also have another way of reproducing.



Plant a single clove of garlic, and it will grow a new garlic plant. This new plant will then produce another garlic bulb with up to a dozen cloves. Each one of these cloves can become its own plant.

One tulip plant will become a group of tulip plants.





# Activity 6: Growing a Carrot

Can you use an old carrot to grow a new carrot? Find out in this activity.



## What you need



- soil
- a knife
- an old carrot that has started to sprout green leaves
- a clear plastic cup with a hole in the bottom
- a saucer or tin pie plate (to catch excess water)



Ask an adult helper to help you cut off the top of the carrot in Step 1.



## What to do

1. Ask an adult to help you cut off the top 3 cm of the carrot.
2. Fill the clear plastic cup with soil.

3. Plant the carrot top in the soil, close to the edge of the cup so that you can see it. Don't bury the green top of the carrot.
4. Place the pot in front of a warm, sunny window. Keep the soil damp, but not soaking wet. Keep the saucer or pie plate under the pot to catch any excess water. Watch your carrot grow over the next few weeks.
5. Was pollination needed for your new carrot to grow? Explain your answer.  

---

---
6. Describe two other ways to grow plants without seeds.  

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Check your answers for this activity in the Suggested Answers at the end of this lesson.



Plants grow from

- seeds
- runners
- cuttings
- bulbs

When plants grow from seeds, the new plant has characteristics from two parent plants. Plants that grow from cuttings, runners, and bulbs are exactly the same as the parent plant.



Turn to Assignment Booklet 4A and complete question 6 of the Section 1 Assignment.

## Suggested Answers

### Activity 6: Growing a Carrot

5. Was pollination needed for your new carrot to grow?  
Explain your answer.

No, the carrot grew from a cutting.

6. Describe two other ways to grow plants without seeds.

Plants can also be grown from runners and bulbs.



## Key Words

**clone:** a plant that is identical to its parent; a plant produced by cuttings, runners, or bulbs

**runner:** a stem that grows along the ground and takes root

**cutting:** a part cut from a plant to grow a new plant

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# Section 1

## Conclusion

You have studied the parts of a plant and their functions in supporting the growth and reproduction of the plant. By now, you must have a large collection of plants growing around you. If someone wants to have plants like yours, could you show them how to start growing his or her own plants? Would you give someone cuttings or seeds from your plants?



Many people make a living growing and selling plants. Next time you are in a greenhouse, you will have a much better understanding of how all those plants came to be there!



Now, turn to Assignment Booklet 4A to complete the Student Feedback Form. Then go to the checklist for Section 1 in your Assignment Booklet. Make sure you have collected everything to send to your teacher.

# Optional Follow-up Activities

## Activity 1: Taking It Apart

The best way to see the parts of a plant is to take a plant apart. Find a flowering plant that you can cut up. Check with the owner of the plant first. Make sure that it is all right to dig it up and cut it up. Make a poster, using cardboard or poster board. Cut off the roots, stem, leaves, petals, and flower (pistils and stamens). Draw and label the parts.



If you have access to the Internet, visit The Great Plant Escape to help you with this project.

<http://www.urbanext.uiuc.edu/gpe/case1/c1facts2a.html>

## Activity 2: Growing a Beanstalk

In Lesson 1, you planted a bean seed. Continue to care for this plant. If necessary, transplant it to a bigger pot. See if you can keep this plant alive until it produces flowers and beans.

## Activity 3: Planting Your Own Garden

Try this activity if the season is appropriate. With an adult's permission and help, plant your own garden. Before you plant, plan your garden. Will you start plants from seeds or cuttings? Or will you buy small plants from a nursery? Make sure you choose plants that will grow well in your climate. Plan how you will fertilize and care for the soil. Think about the amount of water and light that your plants will need.



## Activity 4: Growing Your Own Houseplants

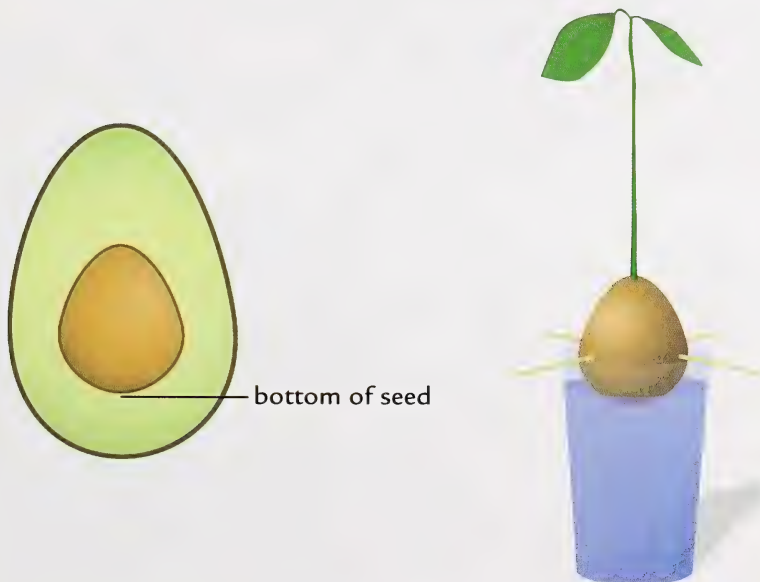
You started growing a plant from a carrot top in this section. Why don't you try growing plants from seeds you might have in your kitchen? For example, try sprouting a lemon, grapefruit, orange, or other fruit seed. You will have to be patient, but these seeds will produce a leafy plant within a few months.

Watching an avocado seed grow is a lot of fun! Avocado seeds grow wonderful plants.



Ask your home instructor for help with inserting the toothpicks.

Wash the avocado seed to remove any remaining fruit. Poke four (round) toothpicks around the centre of the seed so that they stick outward. Rest the toothpicks on top of a glass of water. The bottom of the seed should rest in the water. Keep the glass filled with water at all times. Never let the seed dry out. Place the glass in a bright spot, but not in direct sunlight. Watch for your avocado plant to begin growing! Be patient. (In 2 or 3 weeks, the pit should split or crack. In another 2 to 3 weeks, a root should appear. If the seed doesn't crack before 3 weeks, the seed or conditions may not have been right. You will have to try a different seed.)





# Section 2

## Adaptable Plants

### Introduction



Look out your window. Do you see any trees or shrubs? Even if you can't see any, some sort of plant won't be far away. Plants are all around us, even if we live in a climate that seems too harsh for them to grow. In Alberta, most communities have an environment where plants can grow. However, there are some places in Alberta that have harsh conditions.

In some areas of the planet, it seems impossible for plants to thrive. As you work through this section, think of the plants in your community and the changes they may have had to make in order to survive.



# Lesson 7: Important Plants

Plants are used in more ways than you may imagine. Take a deep breath and thank a plant! Plants help produce the oxygen you need to breathe. Plants take in carbon dioxide from the air, and they release oxygen into the air. Plants need the carbon dioxide you breathe out, and you need the oxygen plants give out!



Look around you. How many things can you see that are made from plants? Today, you will find out how important plants are to you.

**flexible:** bendable



There are many types of plants. Trees are tall plants with woody stems called trunks. Shrubs are smaller, tree-like plants with more **flexible** stems. Some plants have flowers; some are vegetables and fruits that we eat. Grasses are also plants. Farmers grow crops of grasses, such as wheat, barley, and oats.

Plants feed animals. Cattle and other farm animals graze in fields of grass. Without plants, there would be no animals. That includes humans! Animals eat plants, or they eat other animals that eat plants.



Plants do more than feed people and animals. They provide oxygen, shelter, fuel, tools, and medicine. Some plants even help keep water clean. In areas that flood, plants often filter water and help keep it clean. They help the environment and humans.

Trees are very important. Some people burn wood to help keep their houses warm. You may have used a wood fire while camping. The fire kept you warm, provided light, cooked your food, and, possibly even helped keep away biting insects!



People also make many things out of wood. Is your house made of wood? Is any of your furniture made of wood? Look at your pencil. Many pencils are made of wood. Look around you. How many things are made of wood?



Maple sugar is made from the sap of the sugar maple tree. Rubber is made from the sap of rubber trees. Cork comes from the bark of cork oak trees. Ancient plants and trees formed the coal and oil that humans today use as fuel.





Have you seen thatched roofs on houses? They are made of leaves and branches of trees woven together. Thatched walls are also used for people's houses. (This type of house is not common in Canada.)



## Longhouses

Using wood to build houses has a long history in Canada. The Native people on Canada's west coast built houses called longhouses. They used cedar tree trunks and planks cut from cedar trees to build their homes. You can see and hear a First Nation's architect talking about other longhouses at the following website:

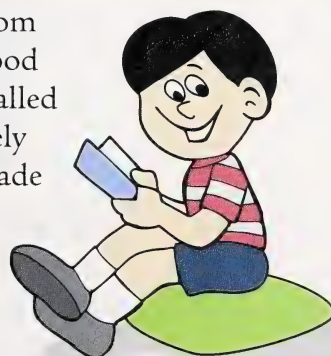
[http://www.nativeaccess.com/allabout/day\\_eng.html](http://www.nativeaccess.com/allabout/day_eng.html)

Click on "Launch *A Day in the Life of an Engineer*." When the introduction is over, click on "15:00." Then, click on the right-hand portrait at the bottom of the new screen.



Another important product made from trees is paper. Paper is made from wood chips. They are turned into a mash called **pulp**. The page you are reading is likely made from trees. (It may be partly made from recycled paper. You will find out more about this in Module 5.)

**pulp:** a soft, moist mixture of ground-up wood, rags, or other material from which paper is made





## Early Paper

The Egyptians were among the first people to make paper. As long as 2800 years ago, Egyptians wrote on paper. They made paper from a plant called papyrus (this word sounds like “paper”).

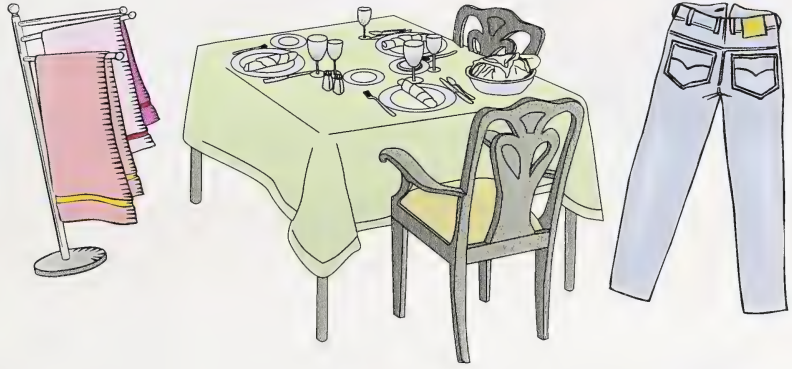
Many other plants have been used for making paper. Watercolour artists use paper made of cotton. In Japan, some paper is made from rice. Paper is also made from other plant products, including straw, linen, and hemp. It is only in the last 100 years or so that trees have been used for making paper. Trees are the most popular source of pulp for paper.

Cutting down trees lets people make paper and wood products. Living trees are also important. Tree roots creep through the soil and form a mesh that holds the soil together. In places where most trees have been cut, heavy rains can wash away the soil.



Trees and other plants are also important for making medicines. For example, the Pacific yew tree provides a drug to help people with cancer. Willow trees contain a natural pain reliever related to Aspirin™. Vitamin C comes from citrus fruits such as oranges, which grow on trees.

Some cloth also come from plants. The cotton in a towel, T-shirt, or jeans comes from cotton plants. Flax plants are made into linen fabric. Linen is used in clothing, tablecloths, and napkins.



Are you good at finding things? Look closely to find things made from plants in your home! Test your powers of observation in Activity 7: Plant Scavenger Hunt!

## Activity 7: Plant Scavenger Hunt

### What to do

1. Look in your kitchen.

a. Find and list two things that are made from trees.

- \_\_\_\_\_
- \_\_\_\_\_

b. List two things that are made from plants other than trees.

- \_\_\_\_\_
- \_\_\_\_\_



c. List two things that you eat and that come from plants.

- \_\_\_\_\_
- \_\_\_\_\_

2. Look in the bedrooms of your home.

a. List three things that are made from trees. .

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

b. List two things that are made from plants other than trees.

- \_\_\_\_\_
- \_\_\_\_\_

3. Look in your basement, the garage, the storage room, or your yard.

a. List two things that are made from trees.

- \_\_\_\_\_
- \_\_\_\_\_

b. List two things that are made from plants other than trees.

- \_\_\_\_\_
- \_\_\_\_\_



Check your answers for this activity in the Suggested Answers at the end of this lesson.

The list of items made from plants seems endless. Even furniture and ropes are made from plants! Plants provide

- food
- shelter
- warmth
- fresh air
- clean water



People need plants to survive!



Turn to Assignment Booklet 4B and complete question 7 of the Section 2 Assignment.

## Suggested Answers

### Activity 7: Plant Scavenger Hunt

1.–3. Your answers will vary.

- a. Find and list two things (in your kitchen) that are made from trees.

Your list may include paper towels and napkins, and wooden bowls, chairs, table, spoons, cutting board, doors, shelves, and cupboards.

- b. List two things (in your kitchen) that are made from plants other than trees.

Your list may include linen or cotton napkins, dish towels, or tablecloths; bamboo or wicker baskets; and string.

- c. List two things that you eat and that come from plants.

Your list may include flour, cereal, vegetables, sugar, spices, and fruits.

2. a. List three things (in the bedrooms of your home) that are made from trees.

Your list may include bed frames, bookshelves, toys, books, chairs, desk, cardboard boxes (from games), and puzzles.

- b. List two things (in the bedrooms of your home) that are made from plants other than trees.

Your list may include cotton or linen throw rugs, clothes, bedsheets, chair coverings, and curtains.

3. a. List two things (in your basement, the garage, the storage room, or your yard) that are made from trees.

Your list may include shelves, chairs, benches, work table, stairs, handles of garden tools, paper, wooden trellis or fence, and doors.

- b. List two things (in your basement, the garage, the storage room, or your yard) that are made from plants other than trees.

Your list may include rope, rubber hammer, paint, corkboard, bicycle or car tires, rubber hose, cotton hammock, and straw brooms.

## Key Words

**flexible:** bendable

**pulp:** a soft, moist mixture of ground-up wood, rags, or other material from which paper is made

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# Lesson 8: Plants and Your Body

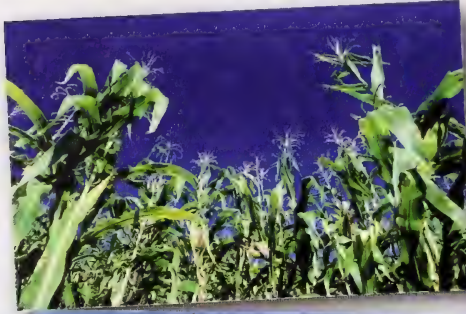
Does your life depend on the plants around you? Your life may not depend on a single houseplant, but you do need plants to survive. Plants take care of you. They feed you and provide the **oxygen** that your body needs. Today, you will discover the ways in which your body needs plants.

**oxygen:** a colourless gas in the air; needed by animals and humans to survive



Did you have toast or cereal for breakfast? If you did, you started your day by eating a plant. Bread and many other foods such as muffins, bagels, and buns contain flour. Grain, usually wheat, is ground into flour. Wheat is one of the most important plants on Earth.

Long ago, people hunted animals and gathered plants for food. Humans found that they could eat the seeds of some grasses. Later, people learned that they could keep the seeds and plant them. Hunting became less important, and people didn't have to keep moving to find animals to hunt. They built homes and villages, and they learned to grow many kinds of plants.



**staple:** an important food item that is used regularly or that is a basic part of a diet

Wheat is often called a **staple**. It is an important part of many people's diets. Rice, corn, and oats are grains that are also staples. These foods can be dried and stored for use year-round.

Grains provide many of the nutrients that you need to be healthy. They do not provide all of them. Your body needs a variety of foods to be healthy. For example, you need vitamin C.





You get vitamin C from oranges, grapefruits, lemons, limes, and some other fresh fruits and vegetables.

Years ago, it was difficult to preserve food safely. Sailors did not have fresh fruits and vegetables on board ship. They didn't get much vitamin C in their diet. As a result, they often suffered from a disease called **scurvy**.

**scurvy:** a disease caused by lack of vitamin C



## A Great Scientist

Dr. Nancy Turner

**ethnobotanist:** a person who studies plants used for food, tools, and medicine by a particular cultural group

Dr. Nancy Turner is a well-known Canadian **ethnobotanist**. She works at the University of Victoria in British Columbia. Botany is the study of plants and “ethno-” refers to cultural groups.

For a long time, Dr. Turner has been interested in plants used by Native Peoples. When she was younger, she used to make foods from wild plants.

Her foods didn't taste very good. Later, she learned the correct way to use wild plants. She learned a great deal from Native elders.

Dr. Turner has written several books about the plants that Native people used for food.





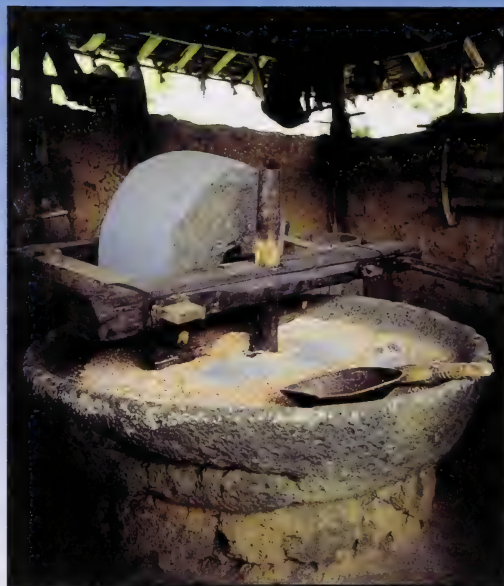


Years ago, people used grist mills to grind wheat into flour. Water or wind-turned wheels moved large stones to grind the wheat.

To see a picture of a grist mill, go to the following website. This website provides information about an active grist mill run by the Nicolston family in Alliston, Ontario.

<http://www3.sympatico.ca/nicolston-dam/Gristmill.htm>

You can also do a search using the words "grist mill."



## Activity 8: Grinding Grain

In this activity, you will grind your own grain.

### What you need



- 250 mL grain (wheat, oats, rice, or barley)
- 2 pieces of clean cloth
- a rolling pin
- a sieve

### What to do

1. Place a few spoonfuls of grain between the pieces of cloth.

2. Roll the rolling pin back and forth over the cloth to crush the grain. Press down hard on the rolling pin as you roll it over the grain.
3. Pour the crushed grain through the sieve. You can now try crushing the coarse grain bits that did not go through the sieve. Add a spoonful of grain to the coarse bits. Repeat Step 2 and Step 3 until all your grain is ground.



4. How does your result compare to flour from the store?

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5. What is another way you could crush the grain?

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6. How did people grind grain long ago?

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Check your answers for this activity in the Suggested Answers at the end of this lesson.

We need oxygen to survive, and plants give us the oxygen we need! When you breathe, your lungs take in oxygen and release another gas called carbon dioxide. Plants absorb carbon dioxide and give off oxygen. Remember photosynthesis from Lesson 1. It has the plant make sugar to grow and you get the oxygen you need.



In cities, there is often a lot of pollution from vehicles and factory smokestacks.

Plants help clean the air. Air pollution includes lots of carbon dioxide. As plants use carbon dioxide, they help clean the air.



Some people believe that plants grow better when you talk to them. Maybe they do.

When you get close to a plant and speak, you breathe out carbon dioxide. Carbon dioxide is a gas that plants need in order to grow.



Turn to Assignment Booklet 4B and complete question 8 of the Section 2 Assignment.



## Suggested Answers

### Activity 8: Grinding Grain

4. How does your result compare to flour from the store?

Your answers will vary. Most likely the flour from the store is finer and softer.

5. What is another way you could crush the grain?

Your answer may vary, but you could use one of these methods:

- Use a stone or bottle to crush the grain.
- Jump on the grain.
- Use a grinder, such as a coffee grinder.
- Use a mortar and pestle.

6. How did people grind grain long ago?

People used large stone wheels to grind grain. The grain could be ground into coarse animal feed, a porridge, or a fine flour. The stone wheels were turned by wind or water wheels. The Internet link for this lesson shows you what a grist mill looks like.

## Key Words

**ethnobotanist:** a person who studies plants used for food, tools, and medicine by a particular cultural group

**oxygen:** a colourless gas in the air; needed by animals and humans to survive

**scurvy:** a disease caused by lack of vitamin C

**staple:** an important food item that is used regularly or that is a basic part of a diet

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## Lesson 9: Changing Conditions

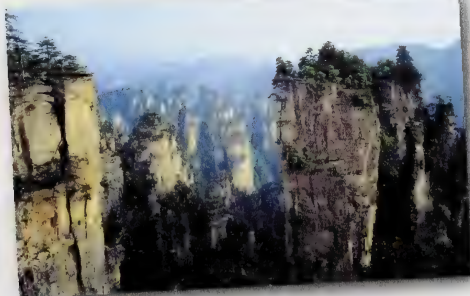
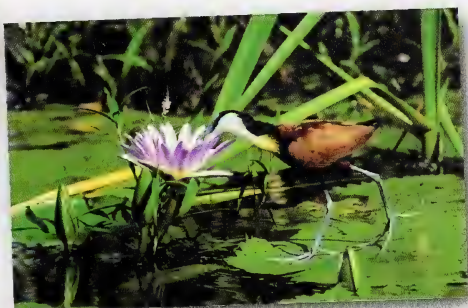
If you ate only half your meals, you would lose weight. If you had only a few sips of liquid each day, you would feel thirsty most of the time. Hungry and thirsty people have less energy, and they can become unhealthy.

Plants can be hungry and thirsty too. Without the right soil, plants do not grow. Without water, they lose energy and wilt.

Today, you will explore how different conditions affect plants.



Each type of plant survives in different growing conditions. A cactus lives in the hot, dry desert. A fern lives in a damp, shady forest. When you buy a plant, how do you know what it needs? Potted plants often come with plastic tags. These tags have symbols drawn on them. A big round Sun shows that the plant likes full sun. Raindrops show that the plant likes plenty of water. When you were planting seeds, you discovered that seed packets tell you what the plant needs.



You can tell much about plants by looking at the ones around you. Native plants grow in the places they like best. Daisies and dandelions grow in a variety of conditions. They do not need shade or rich soil. Other plants need more shade and moisture.

Many trees love the Sun. They grow quickly whenever there is an opening in the forest. Their branches stretch up to the Sun. Other trees grow in shady areas. They grow slowly. Their branches may never reach a sunny spot. Often these trees have large leaves, or millions of tiny leaves or needles so they can capture plenty of sunlight.



People have studied many types of plants, so they can give plants the conditions they need to grow.

Tomatoes like heat, sunshine, and rich soil. They grow very well in warm climates. In Canada, gardeners plant tomatoes in warm places in their gardens, or they grow them in greenhouses so that the plants do not get cold. They water the plants and add nutrients to the soil. Growers create the conditions the plants like so the plants will grow well.



## Activity 9: *Green Bender*



In this activity, you will become a plant scientist.

Do you think you can change the way a plant grows? You will find out in a short time.

## What you need



- a small, leafy potted plant with a long stem
- a cardboard box (with a lid) that will fit your plant
- scissors or a utility knife

## What to do

1. Where did you get the plant? Was it warm, sunny, or shady? Was it growing indoors or outdoors?

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2. What conditions does the plant like? (You can get this information from the owner of the plant or from a tag that comes with the plant.)

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3. Draw your plant in the space below.

A large, empty rectangular box with a thin black border, intended for a student to draw their plant inside.



Have an adult cut the opening in the box if a utility knife is used.



4. Ask an adult to help you cut a hole, about 7 cm across, in one side of the box.
5. Water the plant and place it in the box. Close the lid.
6. Place the box in a sunny spot and leave the plant for 4 or 5 days. Choose a spot where the box will not be disturbed. Do not move the box.
7. Remove the plant from the box. How has the plant changed?

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8. How were the growing conditions different inside the box?

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9. Why do you think your plant changed shape?

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10. What might make plants change their shape in nature?

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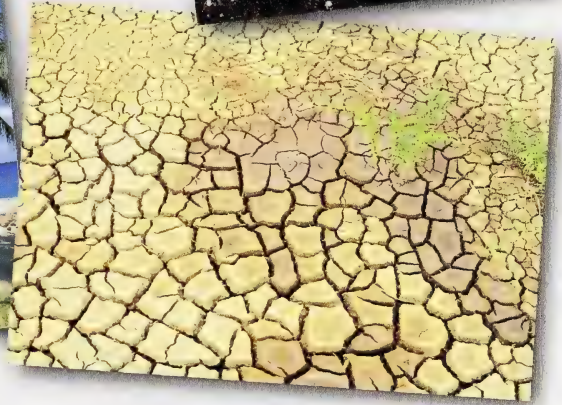


Check your answers for this activity in the Suggested Answers at the end of this lesson.



Different plants need different growing conditions.

Some plants like shady, damp places, and some plants like sunny, dry places. Some plants grow best in rich, dark soil; others grow best in sandy soil or clay.



When the growing conditions change, plants change. If light comes from one direction, plants will grow toward the light. If the winds blow from one direction, the plants will bend. If plants don't get enough water or if they get too much Sun, they will wilt. Light, rain, and soil conditions affect how plants grow.



Turn to Assignment Booklet 4B and complete question 9 of the Section 2 Assignment.

### Activity 9: Stem Bender

1. Where did you get the plant? Was it warm, sunny, or shady? Was it growing indoors or outdoors?

Answers will vary. Sample answers might be like the following:

- The plant came from the hanging basket on the patio. It was warm and sunny.
- The plant came from the end table in the living room. It was warm and shady.

2. What conditions does the plant like? (You can get this information from the owner of the plant or from a tag that comes with the plant.)

Answers will vary. Sample answers might be like the following:

- The plant grew in potting soil in a sunny spot on the patio.
- The plant grew in garden soil in the shade.
- The plant needs to be watered often.
- The plant doesn't need much water.

3. Draw your plant in the space below.

Answers will vary. This is a sample drawing of a leafy plant with a long stem. Your drawing may look different.



7. Remove the plant from the box. How has the plant changed?

Your plant probably bent toward the light (the hole cut in the box). Your plant may also have wilted a bit. It may have lost some of its colour.

8. How were the growing conditions different inside the box?

There was less light. The light came from only one direction. The space may have been warmer than the plant was used to (the box was an enclosed space in the sunlight). The plant may have gotten less water than it needed.

9. Why do you think your plant changed shape?

The plant's growing conditions changed. Light came from only one direction, so the plant bent toward the light.

10. What might make plants change their shape in nature?

Trees and other plants will stretch toward the light. In a dark forest, trees are often quite tall and skinny as they stretch toward the light. Trees may also grow in the direction of prevailing (most common) winds. Lower branches are often missing in trees getting little light or very poor nutrients.



Plant stems will bend to grow around solid structures. Vines will grow to form the shape of a trellis, or they will wind around the eavestroughing on a house.



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## Lesson 10: Seed Adaptations

Seeds must spread out  
away from the parent plant.  
Think of the thousands of seeds a  
single plant can produce.



The seeds need to spread to new areas  
to grow and mature. There will be fewer other plants  
trying to get the same light, space, and nutrients. How do seeds  
travel?

Seeds move in several ways. They can spread by

- water
- wind
- the actions of animals, people, and moving things and vehicles

Can you think of any seeds that move in these ways?

## Spreading Seeds by Water

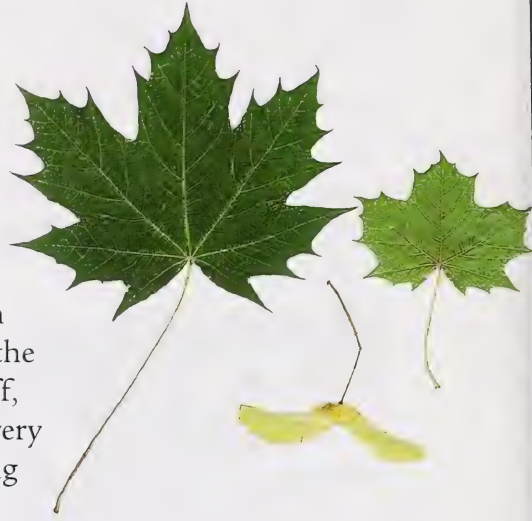


One of the biggest seeds in the world is the coconut. Coconut palms grow on beaches in tropical areas. The part of the coconut that you eat is only a small part of the seed pod. The whole pod is the size of a football or even larger. There is a lot of air trapped in a coconut. This air helps coconuts float. Coconuts fall from the tree onto the shore. Then the tide may pull them out to sea. In time, the coconuts wash up on beaches somewhere else. If the conditions are right, they split open and start to grow. Imagine—before it sprouted, this seed was a boat!

Some plants in Canada also use water to float their seeds. Trees and plants that grow beside water might drop their seeds or cones into the water. The seeds or cones float until they wash up on shore elsewhere.

## Spreading Seeds by Wind

Some seeds catch a ride on the wind. Their parent plants produce seeds that look like they have wings. Maple trees have seeds that are often called maple keys or helicopters. They look like the propeller blades of a helicopter. You can see them dangling on tree branches in the fall. The wind pushes them off, and they start to spin. If it is very windy, they can fly quite a long distance from the tree.



Dandelion and milkweed seeds also move to new areas in the wind. After flowering, dandelion flower heads become round balls of fluff. With one big breath, you can blow the seeds away. They are so light that they float easily on the wind. When milkweed seed pods are

ripe, they burst open. Tiny pieces of fluff are attached to the seeds. The fluff acts like a parachute. The parachute catches the wind, and the seeds blow away instead of falling down.

## Spreading Seeds by Animals

Animals carry seeds. Squirrels bury nuts in the soil to save them for winter food. Sometimes they forget where they have hidden the nuts. Without knowing it, they have planted trees! This is good for the trees and good for the squirrels. The more trees that grow, the more food there will be for the squirrels.





Animals such as birds and bears love to eat fruit. The seeds are hard to digest. These animals leave small piles of undigested seeds in their waste. Undigested seeds in an animal's stomach sometimes travel far away from their parent plant.

Animals help seeds to travel in another way. Have you ever seen burrs or thistles stuck to a dog's fur? Maybe they were stuck to your own clothes after a walk. Burdock seeds are covered with tiny hooks that look like miniature thorns. These hooks stick to things. They may also prick. Dogs will try to get rid of burrs with their teeth or their claws.



A burr gave an inventor the idea for Velcro™. George de Mestral, a Swiss engineer, came back from a walk in the woods. He saw that tiny seeds covered in hooks were stuck in his clothing and his dog's fur. This "planted the seed" in his mind to create a fastener that developed into Velcro™.



To discover more about the invention of Velcro™, go to the Velcro KIDZONE website.

<http://www.velcro.com/kidzone.html>

Seeds travel in different ways. Not all seeds that travel will germinate or grow into plants. Some seeds land in places where they are unable to grow. Some seeds sprout, but the seedlings die from frost, drought, or disease.

# Activity 10:

Seed Science

Does the size or weight of a seed affect how it is spread by wind and water? Try this activity to find out.

## What you need



- grass seeds, dill seeds, or celery seeds
- pumpkin, sunflower, or watermelon seeds
- a cone from a coniferous tree (pine, spruce, fir)
- a dry bean, pea, or corn
- a walnut, pecan, or hazelnut (in its shell)
- a table fan (optional)
- a bucket or sink filled with water

## What to do



1. In the first column of the chart on the next page, write the names of the seeds you are using.
2. Read Step 3 and Step 4. Predict which of your seeds will spread better by air and which will spread better by water. Write your prediction in the second column.
3. Line up the seeds on a tabletop. Blow on them or point the fan (set to low) so that it blows on the seeds. In the third column of the chart, describe what happens to each type of seed. Use point form.
4. Add the seeds to a bucket or sink filled with water. In the fourth column of the chart, describe what happens to each type of seed. Use point form.

Seeds	Prediction	Results	
	I think the seed will spread better by _____.	Wind Blowing	Putting in Water

5. a. Which of your seeds are most likely to be spread by wind?

b. Why are these seeds most likely to be spread by wind?



6. a. Which of your seeds are most likely to be spread by water?

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b. Why are these seeds most likely to be spread by water?

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Check your answers for this activity in the Suggested Answers at the end of this lesson.



Wind, water, and animals move seeds away from the parent plants. Light seeds will travel easily on the wind. Fruit seeds will float away on water because air is trapped inside the shell. Seeds with tiny hooks will catch in an animal's fur and be carried to places away from the parent plant. Animals also eat seeds that they do not digest. The seeds are left in the animal's waste.



Turn to Assignment Booklet 4B and complete question 10 of the Section 2 Assignment.

# Activity 10: Seed Science

1. In the first column of the chart on the next page, write the names of the seeds you are using.

Answers will vary. Sample answers are shown in the chart (in Step 2).

2. Read Step 3 and Step 4. Predict which of your seeds will spread better by air and which will spread better by water. Write your prediction in the second column.

Answers will vary. You may have used the size and weight of the seeds to predict how they will spread. Sample answers are shown.

Seeds	Prediction	Results	
	I think the seed will spread better by _____.	Wind Blowing	Putting in Water
grass seed	air	moves very easily	floats
walnut	air	moves a bit	floats
pumpkin seed	both	moves easily	floats
corn	air	moves easily	sinks
pine cone	water	moves a bit	floats

3. Line up the seeds on a tabletop. Blow on them or point the fan (set to low) so that it blows on the seeds. In the third column of the chart, describe what happens to each type of seed. Use point form.

The lightest seeds, such as the grass seeds, spread easiest. The stronger the wind, the heavier the seed that will be moved and the farther the seeds will be carried.

4. Add the seeds to a bucket or sink filled with water. In the fourth column of the chart, describe what happens to each type of seed. Use point form.

Most of the seeds probably floated. If the seeds were in the water for some time, some of the seeds, such as the grass seed, may have become waterlogged and sunk.

5. a. Which of your seeds are most likely to be spread by wind?

The lightest seeds, such as the grass seed, are most likely to be spread by the wind.

- b. Why are these seeds most likely to be spread by wind?

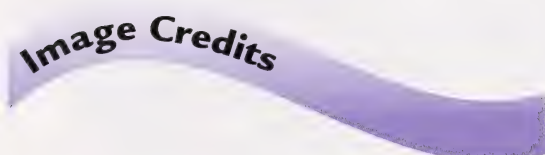
They are small in size, and they are lightweight.

6. a. Which of your seeds are most likely to be spread by water?

Any of the seeds could probably be spread by water. The nuts in their shells float best.

- b. Why are these seeds most likely to be spread by water?

There is air trapped inside the shells that helps them float. The very light seeds, such as grasses, will also float until they become waterlogged.



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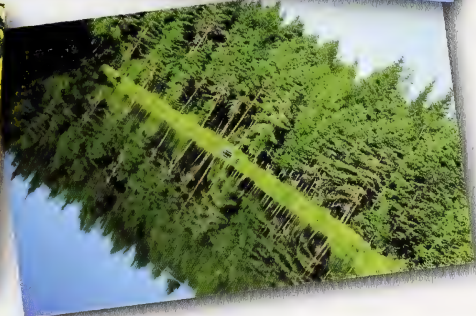
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# Lesson 11: Plants Around You

The best way to find out about plants is to look around you. What kinds of plants grow where you live? In this lesson, you will look more closely at plants that grow in your area.



Forests cover many areas of Canada, but these forests are not all the same. There are many different types of forests—from the temperate rain forests on the west coast to the Acadian forests on the east coast. Each type of forest includes a variety of trees and other plants. These plants grow together because they like the same conditions.

A forest may have one name, but it includes many different plants. It is like a small town. The town has one name, but many citizens. A forest is a plant community, just like a town is a human community.

Not all plant communities are forests. The prairies are a plant community. Prairies are grasslands. In this plant community, the plants do not grow tall like trees. Plants have to survive strong winds and very little rainfall. They develop thick mats of roots that weave together to hold them in place. Plants such as small shrubs, flowers, and mosses also grow on the prairies. If you look closely at a small patch of prairie, you will be surprised how many different plants you find.



Other plant communities in Canada include lakes and wetlands where water plants grow. There are also arctic and alpine areas where the climate is extremely cold and often very windy. Plants have to be very tough to live in these areas.



You can read more about plant life in the Arctic and also view pictures of some of the plants that grow there by visiting this website.

<http://www.saskschools.ca/~gregory/arctic/Aplants.html>

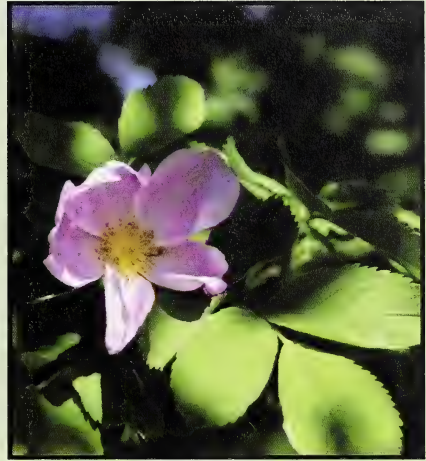




## Provincial Parks

Every province has a provincial tree and flower to represent the plants of the province.

In Alberta, the provincial tree is the lodgepole pine, and the provincial flower is the wild rose. Do you recognize them?



Plant communities are a group of plants that might include trees, shrubs, and grasses. Plant communities live in areas that have different characteristics, including different soil types, differing amounts of rain or snowfall, and other weather conditions. Often, certain animals live only in particular plant communities.

Imagine a plant community high in the mountains. High in the mountains, it is windy and cold. There is very little soil. Plants that grow there must be able to survive in these conditions. The plants that can grow there are very different from those that live in a swampy area or in a forest. Swampy areas are very wet, so plants that grow there like plenty of moisture.



Many forests in central Alberta are aspen-poplar forests. This plant community includes aspen and poplar trees, wild rose bushes, pea vines, and a variety of grasses. These plants grow well in the soil, moisture, and weather conditions of this area.



## Activity 11: Plants Near You

In this activity, you will describe a natural plant community in your area. This should be a natural (undisturbed) area. Do not use a garden or a park where people care for the plants.

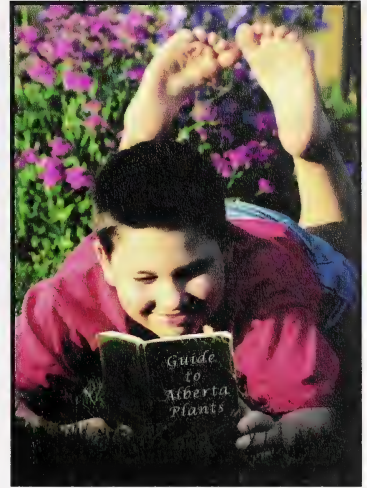


## What you need



- a guide to the plants of your area

**Note:** Your family may already have a book like this. Perhaps you and your family will want to purchase such a guide. You can also check the library in your community.



## What to do

1. Look for the following plant types in and around your community. Use the plant guide to describe and identify one plant of each type. **Discuss your plant choices with your home instructor.** You may also sketch the plants on a separate piece of paper. (You may share your drawings with your family and teacher. You may also wish to keep a diary of plants you see as you visit different places.)

a. tree

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b. flowering shrub or bush

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c. small flowering plant (non-woody stem)

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d. wild berry

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2. Describe the climate where you live. (Is it dry, warm, cold, snowy, wet, or windy? Is there a long summer or a short summer? Does the ground freeze in winter?)

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3. How are the plants you found in your area suitable for the climate conditions?

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Check your answers for this activity in the Suggested Answers at the end of this lesson.





Cacti grow in the Alberta Badlands.



Cattails grow in Alberta's wetlands.

The plants that grow in any plant community are suited to the soil type, the amount of moisture, and the weather in that area. As these conditions vary from area to area, so do the plants.



Turn to Assignment Booklet 4B and complete question 11 of the Section 2 Assignment.

## Suggested Answers

### Activity 11: Plants Near You

1. **a.-d.** Look for the following plant types in and around your community. Use the plant guide to describe and identify one plant of each type. You may also sketch the plants on a separate piece of paper. (You may share your drawings with your family and teacher. You may also wish to keep a diary of plants you see as you visit different places.)

Your answers will vary. Try to ensure that you choose plants that are native plants, not those that are planted in a garden. If you are having difficulty, look through the plant guide and find a few plants that grow in your area. Plant guides usually have maps in them that show where types of plants grow.

2. Describe the climate where you live. (Is it dry, warm, cold, snowy, wet, or windy? Is there a long summer or a short summer? Does the ground freeze?)

Your answer will vary. Try to think of the conditions that might affect the growth of plants.

3. How are the plants you found in your area suitable for the climate conditions?

Generally, plants in Alberta and many parts of Canada will have to adapt to long, cold winters and short, hot summers. The amount of rain and snowfall will vary throughout the provinces and territories. The plants would also be adapted to the soil type.

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# Section 2

## Conclusion

Plants are amazing! They can grow and thrive in the harshest conditions because they adapt to their surroundings. Our planet has conditions that range from scorching heat to extreme cold. Yet evidence of plant life is in all these areas.



In this section, you have seen how plants benefit people. We seldomly think about how our oxygen is produced or where our food comes from. We do not look at the houses being built and think about the materials used to build them. As you go outside and look at the environment around you, you will now be more aware of the part that plants play in your life.



# Optional Follow-up Activities

## Activity 1: Recycled Paper



Make your own paper from paper scraps. For instructions on how to make your own paper, visit the following websites:

- [http://www.bcpl.info/kidspage/kids\\_flem\\_papermaking.html](http://www.bcpl.info/kidspage/kids_flem_papermaking.html)
- [http://www.bcplonline.org/kidspage/kids\\_flem\\_handmadepaper.html](http://www.bcplonline.org/kidspage/kids_flem_handmadepaper.html)

## Activity 2: Recycling, Reducing, and Reusing Plant Products

Did you know that if you recycle 100 newspapers, you save a tree? Recycling is a good way to save trees. There are other ways, too. If you reduce your use of paper, you can reduce the number of trees that are cut.

Record a list of ways to use less writing paper, paper towels, and paper shopping bags. You can also save trees by reusing paper and other plant products. For example, you can draw on both sides of a piece of paper and then make your own paper from these papers (See Activity 1). Cotton or linen fibres can also be added to your recycled paper.



## Activity 3: Making a Maple Seed

### What you need



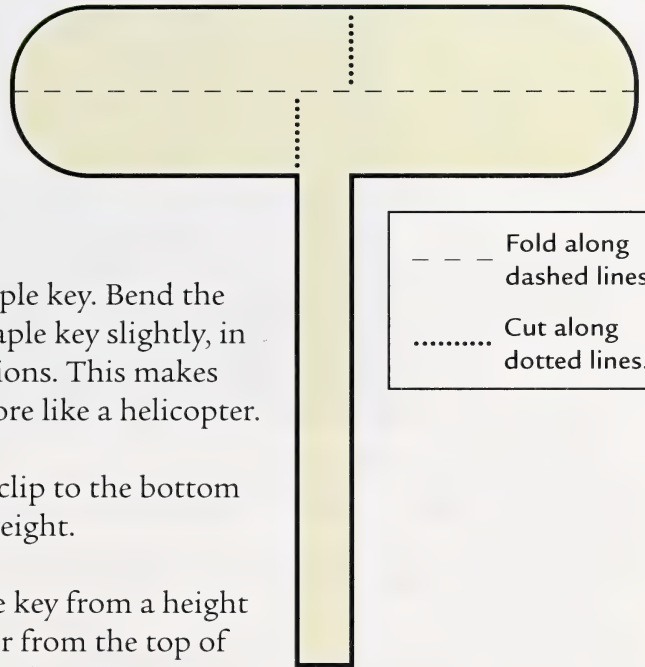
- a pencil
- paper
- scissors
- a paper clip
- maple key pattern

### What to do



You may need your home instructor's help with cutting and folding your maple key.

1. Trace the outline of the maple key shown here onto the piece of paper.
2. Cut out the maple key. Bend the wings of the maple key slightly, in opposite directions. This makes the key look more like a helicopter.
3. Attach a paper clip to the bottom of the key for weight.
4. Drop the maple key from a height (off a balcony or from the top of the stairs) to see the twisty path maple seeds take as they fall to the ground.



## Activity 4: Growing a Plant for Seeds

Write a report on the plant you grew to maturity. Include sketches of your plant as it grew.

# Module Summary

Is your thumb a little greener after completing this module? People who are good with plants are sometimes said to have “green thumbs.” In this module, you discovered that plants need the right combination of water, light, and nutrients. You also studied new words, such as *photosynthesis* and *chlorophyll*. You know that flowers are more than just beautiful things to look at and smell. They are needed to create seeds for new plants.



It is important to know about green plants, because you need them for a healthy diet and a healthy planet. Plants play a huge role in our lives. It is our responsibility to keep our planet healthy so that plants can continue to grow, and provide us with food, shelter, clothing, heat, medicine, oxygen, and much more. In Module 5, you will explore how you can help look after our environment. So, take a deep breath, munch on a carrot, smell a beautiful flower, and thank a plant!



Now, turn to Assignment Booklet 4B to complete the Student Feedback Form. Then go to the checklist in Assignment Booklet 4B. Make sure you have collected everything to send to your teacher.



## Glossary

**annual:** a plant that grows for only 1 year or season

**carbon dioxide:** a colourless gas that plants absorb from the air

**chlorophyll:** the green pigment (colouring) of plants; needed for photosynthesis to absorb the light energy of the Sun

**clone:** a plant that is identical to its parent; a plant produced by cuttings, runners, or bulbs

**compost:** decayed organic matter

**coniferous:** referring to trees that have needle-shaped evergreen leaves and bear seeds in cones; needles remain over winter

**cutting:** a part cut from a plant to grow a new plant

**deciduous:** referring to trees that lose their leaves in winter

**embryo:** the undeveloped plant within a seed

**ethnobotanist:** a person who studies plants used for food, tools, and medicine by a particular cultural group

**fertilization:** the process that occurs when male reproductive cells unite with a female reproductive cell

**fertilizer:** a substance put in soil to improve plant growth

**flexible:** bendable

**germinate:** to begin to grow or sprout

**glucose:** a simple sugar

**growing season:** the number of days that the conditions are right for growing plants outdoors

**growth cycle:** the different steps a plant goes through from seed to maturity and production of new seeds

**growth ring:** ring formed in a tree trunk during each year's growth; also called a **tree ring** or **annual ring**

**maturity:** at the adult stage of life

**mulch:** straw, bark, or manure spread to protect soil and plant roots

**nutrients:** substances that nourish or feed

## Glossary (continued)

**ovary:** the part of the pistil that contains the female reproductive cells of the plant

**oxygen:** a colourless gas in the air; needed by animals and humans to survive

**perennial:** a plant that lives for more than 2 years or growing seasons

**photosynthesis:** the process by which plants use sunlight, carbon dioxide, and water to make a type of sugar

**pistil:** the part of the flower that produces seeds

**pollen:** fine, yellowish particles that contain male reproductive cells of a plant

**pollination:** the process that occurs when pollen from stamens lands on pistils

**pulp:** a soft, moist mixture of ground-up wood, rags, or other material from which paper is made

**runner:** a stem that grows along the ground and takes root

**scurvy:** a disease caused by lack of vitamin C

**stamen:** the male reproductive organ of a flower

**staple:** an important food item that is used regularly or that is a basic part of a diet

**veins:** thread-like pipes in a leaf







